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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/917,874	07/31/2001	Yoshiaki Kuroki	Q65641	2065

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EXAMINER	
OLSEN, KAJ K	
ART UNIT	PAPER NUMBER
1753	

DATE MAILED: 05/15/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No. 09/917,874	Applicant(s) KUROKI ET AL.	
	Examiner Kaj Olsen	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Peri d for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 26 February 2003.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1,3-12 and 14-20 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1,3-12,14-20 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1, 3-8 and 14-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata '174 in view of Mase '693.

3. Shibata discloses a multi-layer gas sensor comprising a solid electrolyte member 14, a porous member 12, and a substrate (18 with or without element 15). Shibata teaches the use of an electrolyte member having a thickness of 100 microns, a porous member having a thickness of 100 to 200 microns, and a substrate 18 having a thickness of 200 to 600 microns (col. 3, lines 31-50 and 58-61; and col. 4, lines 11-18). Hence the porous member and substrate both have a thickness larger than the electrolyte member (including 1.5 times larger than the electrolyte member) and sandwich the electrolyte member (fig. 1). The substrate and porous member are disclosed as being constructed solely out of a magnesia-alumina spinel (col. 3, line 41 and col. 4, line 16). Hence the volume percent of the specified spinel in the porous member (i.e. R2) is 100% of the volume percent of the specified spinel in the substrate (i.e. R1). 100% is greater than 60%, 80%, 90%, and 95% as set forth by the claims. Shibata did not explicitly specify having the mean grain size of the crystals for the substrate and porous member satisfy the claimed relationship. However, the claimed relationship would appear to be satisfied when the

porous material and substrate are constructed with the same grain sized starting materials (i.e. "A" would equal 1 under such a condition). Mase teaches in an alternate gas sensor that the various ceramic layers of the gas sensor should be constructed to have the firing shrinkage rate that minimizes warping and Mase also teaches one of the means for accomplishing that is to utilize ceramic pastes having the same particle sizes (i.e. the same mean grain size material (col. 2, lines 38-54 and col. 6, lines 34-47)). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Mase for the gas sensor of Shibata in order to minimize the warping of the sensor during the firing step of sensor construction or during the exposure of the sensor to high temperature exhaust gases.

4. With respect to claim 18 (those limitations not covered above), the magnesium-alumina spinel is inherently a crystalline material and would thereby form crystals. With respect to claim 19, the component of highest volume content in spinel is Al_2O_3. Alternatively, Shibata also teaches the suitability of alumina itself (i.e. Al_2O_3) as a ceramic material for the device (col. 3, lines 40 and 41).

5. With respect to the claimed porosities (or densities) of the porous member, Shibata teaches the use of a porosity of 5-20% (or a density of 80-95%, which overlaps the claimed ranges of porosity and density.

6. Claims 1, 3-12 and 14-19 are rejected under 35 U.S.C. 103(a) as obvious over Takahashi '485 in view of Mase '693.

7. Takahashi discloses a multi-layer gas sensor comprising an electrolyte member 3, a substrate 6, and a porous member 2. The electrolyte member thickness is disclosed as being between 0.1 to 30 microns (see abstract), while the substrate is disclosed as being considerable

thicker than the electrolyte (col. 5, lines 48-52). The upper portion of the porous member and the substrate sandwich the electrolyte member (fig. 6, 9). The porous member is described as being "not less than 1 [micron]" (abstract) with a specific example of 10 microns (col. 9, lines 51-54). Hence Takahashi would appear to anticipate the claim requirement that the electrolyte thickness to be less than the thickness of the substrate and porous member when the electrolyte of Takahashi is chosen to be 10 microns or less. However, because Takahashi is drawn to a broad range of porous member and electrolyte thickness without specific examples satisfying the claimed range, the examiner recognizes that Takahashi might not teach the claimed ranges with "sufficient specificity" as required by MPEP 2131.03. However, it would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Takahashi with an electrolyte thickness of less than 10 or 1 microns because Takahashi has taught that the thinner the electrolyte is made, the greater the conductivity is (fig. 2). Hence the thinner electrolytes in the specified range would provide the greatest sensor response. Takahashi set forth all the limitations of the claims, but did not explicitly specify having the mean grain size of the crystals for the substrate and porous member satisfy the claimed relationship. However, the claimed relationship would appear to be satisfied when the porous material and substrate are constructed with the same grain sized starting materials (i.e. "A" would equal 1). Mase teaches in an alternate gas sensor that the various ceramic layers of the gas sensor should be constructed to have the firing shrinkage rate that minimizes warping and Mase teaches that one of the means for accomplishing that is to utilize ceramic pastes having the same particle sizes (i.e. the same mean grain size material (col. 2, lines 38-54 and col. 6, lines 34-47). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching

of Mase for the gas sensor of Takahashi in order to minimize the warping of the sensor during the firing or annealing step of sensor construction or during the exposure of the sensor to high temperature exhaust gases.

8. Takahashi also teaches the use of Al_2O_3 as the sole ceramic component for both the porous member and the substrate (see abstract and col. 9, lines 24 and 25). Hence the volume percent of alumina in the porous member (i.e. R2) is 100% of the volume percent of the specified alumina in the substrate (i.e. R1). 100% is greater than 60%, 80%, 90%, and 95% as set forth by the claims. With respect to claim 18 (those limitations not covered above), alumina is inherently a crystalline material and would thereby form crystals.

9. With respect to the claimed porosity or density, Takahashi specifically teaches the use of porosity of 30% (or a density of 70%) (fig. 4), which overlaps the claimed range of porosity or density.

10. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Shibata '174 and Mase '693 as applied to claim 1 above and in further view of Friese '650 with evidence from the Practical Handbook of Materials Science.

11. The references set forth all the limitations of the claims, but did not explicitly teach the addition of a ceramic component from the substrate and porous member into the electrolyte. Friese teaches that the addition of insulating materials such as alumina or magnesium-alumina spinel to the electrolyte improves the thermal shock resistance and heat conductivity of the constructed sensor (col. 3, lines 2-58). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Friese and add the alumina or magnesium-alumina spinel ceramic from Shibata to the electrolyte of Shibata to improve the

thermal conductivity and thermal shock resistance of the constructed sensor. Friese specifies adding between 8 and 85% of the ceramic by volume, but does not specify the amount in terms of mass as set forth by the claim. However, the densities of zirconia, alumina, and magnesium-alumina as shown by the Practical Handbook of Material Science evidence that the specified volume range of ceramic from Friese still overlaps the claimed mass range of ceramic even when the small differences between the densities of zirconia, alumina, and magnesium-alumina are accounted for.

12. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takahashi ‘485 and Mase ‘693 as applied to claim 1 above and in further view of Friese ‘650 with evidence from the Practical Handbook of Materials Science.

13. The references set forth all the limitations of the claims, but did not explicitly teach the addition of a ceramic component from the substrate and porous member into the electrolyte. Friese teaches that the addition of insulating materials such as alumina or magnesium-alumina spinel to the electrolyte improves the thermal shock resistance and heat conductivity of the constructed sensor (col. 3, lines 2-58). It would have been obvious to one of ordinary skill in the art at the time the invention was being made to utilize the teaching of Friese and add the alumina or magnesium-alumina spinel ceramic from Takahashi to the electrolyte of Takahashi to improve the thermal conductivity and thermal shock resistance of the constructed sensor. Friese specifies adding between 8 and 85% of the ceramic by volume, but does not specify the amount in terms of mass as set forth by the claim. However, the densities of zirconia, alumina, and magnesium-alumina as shown by the Practical Handbook of Material Science evidence that the specified volume range of ceramic from Friese still overlaps the claimed mass range of ceramic even when

the small differences between the densities of zirconia, alumina, and magnesium-alumina are accounted for.

Response to Arguments

14. Applicant's arguments filed 2-26-2003 have been fully considered but they are not persuasive. Applicant urges that Shibata or Takahashi in view of Mase fails to teach the claimed invention. In particular, applicant urges that the claims should be withdrawn because applicant has incorporated the limitations of claim 13 into claim 1. However, claim 13 was anticipated by, or rendered obvious, over the teachings of Shibata and Takahashi. Absent any particular showing from the applicant why the teachings of Shibata or Takahashi fail to teach said limitations of now cancelled claim 13, the rejections are maintained. With respect to the rejections in view of Mase, applicant appears to be urging that this reference fails to render obvious the claims because the warpage taught by it is greater than 50 times the warpage of the instant invention. However, there is nothing in the claims concerning the degree of warpage allowed by the constructed sensor. The limitations that Mase is being utilized for only require that the ratio of the mean grain sizes of the particles utilized for the layers bounding the solid electrolyte fall in a range that Mase clearly teaches. Moreover, it is unclear if the teaching of Mase as applied to the structures of Shibata and Takahashi would inherently result in a structure having the degree of warpage as taught by instant invention. In particular, if the degree of warpage is a result of a the use of the specified thickness of both the substrate and porous layer (already taught by Shibata and Takahashi) in conjunction with the mean grain sizes falling in the claimed ratio range (like those rendered obvious by Mase), then the teaching of Mase as applied

to Shibata and Takahashi would appear to inherently result in a sensor having the specified minimal warping. Although applicant urges that Mase does not have the specified degree of warpage, Mase is only the secondary teaching and doesn't teach the specified substrate and porous layer thickness.

Conclusion

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kaj Olsen whose telephone number is (703) 305-0506. The examiner can normally be reached on Monday through Thursday from 7:00 AM-4:30 PM. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner are unsuccessful, the examiner's supervisor, Mr. Nam Nguyen, can be reached at (703) 308-3322.

When filing a fax in Group 1700, please indicate in the header "Official" for papers that are to be entered into the file, and "Unofficial" for draft documents and other communications with the PTO that are not for entry into the file of this application. This will expedite processing of your papers. The fax number for regular communications is (703) 305-3599 and the fax number form after-final communications is (703) 305-5408.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist, whose telephone number is (703) 308-0661.

Kaj K. Olsen
Patent Examiner
AU 1753
May 14, 2003

NAM NGUYEN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700